TRANSPORTATION MODEL SHOP REPORT

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INTRODUCTION

The Air Force Center for Environmental Excellence (AFCEE) developed the Air Force Pollution Prevention (P2) Model Shop program to assist Air Force Bases (AFBs) with identification of pollution prevention opportunities (PPOs) and to consolidate efforts of performing pollution prevention opportunity assessments (P2OAs). AFCEE recognized that similar operations were being performed at AFBs, and similar opportunities were being identified. To eliminate this duplication of effort, AFCEE created the Model Shop program by focusing on operations performed in Transportation, Flightline Maintenance, Civil Engineering Operations, Entomology (Pesticides), Retail Sales Facilities, and Food Service Facilities.

The Transportation Model Shop Report was the first P2 Model Shop Report created by AFCEE to present PPOs relating to vehicle maintenance processes. Originally created as desktop summaries of several Air Force P2OAs, no field surveys or base site visits were conducted to validate the information presented in the original report. AFCEE contracted with Parsons Engineering Science, Inc. (Parsons ES) to update the Transportation Model Shop Report to include new PPOs, Management Initiatives, Good Ideas, and Product Substitutions; as well as to validate inclusion of processes performed at vehicle maintenance shops.

The first task included a review of the existing Transportation Model Shop Report and several existing P2OAs to compile a rudimentary list of processes performed and PPOs available to vehicle maintenance facilities. Two Air Force bases (F.E. Warren AFB and Davis-Monthan AFB) were then visited to collect information on the types of vehicle maintenance facilities, typical transportation related operations and processes, typical waste streams generated during vehicle maintenance operations, and waste reduction opportunities already employed. Additional bases (USAF Academy, Fort Carson, and Buckley Air National Guard) were surveyed to refine process descriptions and gather different PPOs and good ideas applicable to vehicle maintenance shops. Although the processes were similar at each shop, the materials used and methods for waste disposal varied considerably from base to base.

PROCESS DESCRIPTIONS

Twenty-two distinct processes are identified in the Transportation Model Shop Report. These processes were developed from the analysis of daily operations at the bases visited. Each process presented was selected because of its unique contribution to vehicle maintenance operations, its use of hazardous materials in the process, or its production of a hazardous waste stream. Some smaller operations were combined because of the minimal opportunities relating to the materials or wastes.

Each process is presented in a parallel manner including a detailed description of the operation; a process flow diagram depicting the materials used in the process and the waste streams produced by the process; and a table of the material inputs and waste streams. Also included with each process is a table summarizing the PPOs, Management Initiatives, and Good Ideas applicable to the process with references to the section with the detailed presentation.

The following is a list of processes presented in the Transportation Model Shop Report:

- Engine Oil and Filter Changes
- Hydraulic, Transmission, and Other POL Fluid Changes
- Antifreeze Changes
- Parts Washing
- Carburetor Cleaning
- Circuit Board Cleaning
- Brake Maintenance
- Battery Maintenance
- Tire Maintenance
- Air Conditioning Service
- Tune-ups, Lubing and Greasing
- Engine and Transmission Rebuilds
- Fuel Tank Maintenance and Fuel Filter Changes
- Radiator Repair, Body Work, Upholstery, and Glass Work
- Paint Removal and Sanding
- Painting
- Refueler Vehicle Tank and Pump System Maintenance
- Fire Truck Aqueous Film Forming Foam (AFFF) System Maintenance
- Vehicle Washing
- Alternative Fuel Vehicle Maintenance
- Rag and Absorbent Use / Spill Cleanup
- General Facility Maintenance

POLLUTION PREVENTION OPPORTUNITIES

Twenty-two PPOs are identified in the Transportation Model Shop Report. These opportunities are recommended to reduce the amount of waste generated and to improve vehicle maintenance processes to become more environmentally friendly. Each PPO has one or more recommendations (alternatives) to the status quo. The PPOs and alternatives were compiled from the existing Transportation Model Shop Report, existing P2OAs, opportunities observed during the base visits, and opportunities researched on the World Wide Web or other P2 resource publications.

Each PPO is presented with a detailed description of the opportunity, a discussion of alternatives, a table of advantages and disadvantages, a technical analysis, an economic analysis, and vendor and reference information. The detailed description presents the assumption of a status quo. The discussion of alternatives presents the separate recommendations identified for the PPO, including the status quo. A list of processes to which the opportunity is applicable is also provided. Two tables are then presented: one outlining the advantages and disadvantages for each alternative compared with the status quo, and the other summarizing the technical analysis, including space, utility, labor, and equipment requirements compared with the status quo.

Following the description and discussion of alternatives is the economic analysis, consisting of a Microsoft Excel spreadsheet with costs for the alternatives and status quo, and tables with the capital and annual operating cost assumptions. The spreadsheet is interactive in the electronic version so that the users can input individual costs to customize the economic analysis. A payback period is calculated for each alternative to help justify capital and annual operating costs compared to the status quo. The user is urged to enter specific base costs to personalize the economic analysis to determine which alternative most effectively reduces pollution and costs.

The following is a complete list of PPOs and alternatives presented in the Transportation Model Shop Report:

PPO	Alternatives
• Extend Engine Oil Change Intervals	Status quo: Change engine oil and oil filter on the TO driven schedule Alternative I: Perform in-shop engine oil analysis Alternative II: Implement laboratory oil analysis program Alternative III: Install engine oil bypass filters in conjunction with laboratory OAP
• POL Filter Handling	Status quo: Dispose used filters as solid waste without crushing them first Alternative I: Crush filters and recycle as scrap metal
• Extend Antifreeze	Status quo: Change antifreeze on TO or other time-driven schedule change intervals Alternative I: Perform antifreeze testing to determine need to changeout
• Antifreeze Recycling	Status quo: Dispose used antifreeze as hazardous waste Alternative I: Recycle antifreeze with a distillation unit Alternative II: Recycle antifreeze with a deionization unit
• Aqueous Based Parts Washing	Status quo: Clean parts in a solvent parts washer without filtration Alternative I: Clean parts in an automatic ("dishwasher") spray washer Alternative II: Clean parts in a sink-type heated aqueous parts washer
• Solvent Parts Washing with Solvent Filtration	Status quo: Clean parts in solvent parts washers without filtration Alternative I: Retrofit solvent filtration onto existing parts washers Alternative II: Use portable solvent filtration on several solvent parts washers Alternative III: New solvent parts washers with solvent filtration
• Solvent Recovery for Parts Washing	Status quo: Dispose of all used solvent as hazardous waste Alternative I: Decant solvents before disposal Alternative II: Distill used solvents on base
• Circuit Board and Small Part Steam Cleaning	Status quo: Clean circuit boards with aerosol solvent and paper towels Alternative I: Clean circuit boards with a steam cleaner
• Paint Gun Cleaning Alternatives	Status quo: Manually clean paint guns with solvent and dispose solvent as hazardous waste after one use Alternative I: Clean paint guns in closed-top paint gun cleaner Alternative II: Clean paint guns in closed-top paint gun cleaner with filtration
• HVLP Paint Guns	Status quo: Use existing conventional paint guns Alternative I: Purchase new HVLP paint guns
• Paint Gun with Paint Pot Liners	Status quo: Clean paint pots with solvent Alternative I: Use paint guns with paint pot liners
• Solvent Recovery for Paint Operations	Status quo: Dispose of all used solvent as hazardous waste Alternative I: Decant solvents before disposal Alternative II: Distill used solvents on base
• Plural Component Proportioning System	Status quo: Manually mix two part paints and dispose of excess Alternative I: Use plural component proportioning system
• Dry Filter Paint Booth	Status quo: Use water wall paint booth Alternative I: Use dry filter paint booth
• Depainting and Sanding Alternatives	Status quo: Use chemical paint stripping Alternative I: Use conventional blast media and dispose as hazardous waste Alternative II: Use conventional blast media and recycle the waste Alternative III: Use "sponge" blast media
• Stenciling Alternatives	Status quo: Spray paint stenciling Alternative I: Manually cut-out adhesive lettering Alternative II: Apply computer generated adhesive stencils
• Aerosol Can Alternatives	Status quo: Use standard aerosol cans and dispose as hazardous waste Alternative I: Deplete aerosol cans and recycle as scrap metal Alternative II: Use refillable pressurized cans for aerosol solvent
• Bulk Distribution	Status quo: Use small units of issue and dispense singularly Alternative I: Use large units of issue and distribute from bulk drum rack Alternative II: Receive products by tanker and pump from holding tanks

PPO	Alternatives
• Absorbent Usage / Spill Cleanup	Status quo: Use absorbent pads once and dispose "wet" with recovered liquid Alternative I: Compact absorbent pads prior to disposal Alternative II: Wring-out absorbent pads and reuse Alternative III: "Dry" absorbent pads in a cyclone and reuse
• Battery Operation Alternatives	Status quo: Use standard, flooded, lead acid batteries Alternative I: Use absorbed electrolyte, gel-cell, lead acid batteries
• Battery Desulfation	Status quo: Recharge batteries without desulfation Alternative I: Install solar desulfation units on individual vehicles Alternative II: Install a multiple-battery desulfation unit in the shop
• Alternative Fuels	Status quo: Use conventional fuel vehicles Alternative I: Convert conventional-fuel vehicles to CNG on base Alternative II: Send conventional fuel vehicles off-base for conversion Alternative III: Purchase originally CNG-powered vehicles

MANAGEMENT INITIATIVE / GOOD IDEAS

Ninety-two Management Initiatives and Good Ideas are identified in the Transportation Model Shop Report. These initiatives and good ideas do not include a detailed description of all alternatives or an economic analysis and can generally be implemented quickly with little or no capital investment. The Management Initiatives and Good Ideas were compiled from existing P2OAs, good ideas observed during the base visits, and ideas suggested on the World Wide Web or other P2 resource publications.

The Management Initiatives are overall recommendations that, if implemented, can contribute to waste reduction goals. The Good Ideas are organized by vehicle maintenance process, although some ideas relate to more then one process. In most cases when equipment or supplies are recommended, a vendor reference has been included.

The following is a list of Management Initiatives / Good Ideas presented in the Transportation Model Shop Report:

Process	Management Initiative / Good Idea
• Basewide	Implement / Participate in Hazardous Material Pharmacy Program Recycle Aluminum, Glass, Plastic, Paper, Cardboard, Etc.
• Engine Oil Changes	Send Used Oil to Be Re-Refined Use Re-Refined Oil Drain Oil Filters Burn Used Oil Filters for Energy Recovery Blend Used Oil with Diesel Fuel Avoid Contamination of Used Oil Collect and Redistribute Residual Oil Recycle Unserviceable 55 Gallon Drums as Scrap Metal Refill Empty Containers from Bulk Distribution System Drain Plastic Containers and Reuse/Recycle Use Synthetic Engine Oil
• Hydraulic, Transmission and Other Fluid Changes	Use Automatic Transmission Flush and Fill Machine Fluid Top-off in Lieu of Fluid Replacement Use Non-Ether Starting Fluid Perform Hydraulic and Transmission Fluid Testing Use Synthetic Transmission Fluid
• Antifreeze Changes	Purchase Recycled Antifreeze Substitute Ethylene Glycol-Based Product with Propylene Glycol Product Transfer Recycled Antifreeze to Bulk Distribution System Skim Oil from Antifreeze with Selective Absorbents Sell Recycled Antifreeze to Customers Donate Excess Recycled Antifreeze to Local Organization

Process	Management Initiative / Good Idea
• Parts Washing	Wipe Off Heavy Grease and Solids before Washing Clean Parts by Hand Whenever Possible Keep Parts Washer Cover Closed When Not in Use Extend Life of Contract Service to Replace Solvents
• Brake Maintenance	Recycle Shavings, Shoes and Pads Return Brake Shoes to Manufacturer/Distributor Use Vacuum Unit with HEPA Filtration
• Battery Maintenance	Use Maintenance-Free Batteries; Trade-Up with Manufacturer Recycle Unchargable Batteries Recycle Battery Cables Use a Ni-Cd Battery Reconditioner
• Tire Maintenance	Recycle Lead Weights and Tires through DRMO Reuse Lead Weights Repair Tires Sell Spent Tires to Road Paver Trade Tires with Manufacturer Purchase Unwrapped New Tires Purchase Retreaded Tires
• Air Conditioning Service	Retrofit Vehicles to non-CFC Refrigerants Recover all Refrigerant for Reuse
• Tune-ups, Lubing and Greasing	Recycle Spark Plug Wires Install Air Filter Element Protector
• Fuel Tank Maintenance/Fuel Filter Changes	Filter Contaminated Fuel for Reuse in Vehicles Reuse Fuel in Non-Mission Critical Vehicles Prevent Inadvertent Mixing of Fuels Install Diesel Gauge on Diesel Engines
• Paint Removal and Sanding	Use Media Blasting Rather than Chemical Paint Stripping Use Paint Preparation Booth With Air Filter Use Vacuum Sanders with HEPA Filtration Use Portable Air Cleaners Where Vacuum Sanders Not Practicable Perform "Paintless" Body Work
• Painting	Schedule Painting by Color Reuse Masking Material and Patch Floor Masking Masking Alternatives Provide Personnel with Painting Training Use Excess Paint as Base Coat for Subsequent Jobs or as Undercoat Reblend Old Paints through Contractor Mix Paints with Mechanical Shaker Make "Safe and Serviceable" the Goal for Vehicle Upkeep Change Paint Booth Filters Based on Differential Pressure Investigate Alternative Painting Methods Use Water-Based and Low-VOC Paints Recycle Paint Cans Consider Extending Service Intervals on Contract Removal Service Use Multiple-Stage, "Step-Down" Cleaning Method
• Refueler Vehicle Maintenance	Change Fuel Filter Based on Differential Pressure
• Vehicle Washing	Install Wash Water Recirculation System Use High-Pressure Hoses with Automatic Shut-Off Nozzles Use Non-Phosphate, Biodegradable Surfactant Formulation Detergents Only Use Approved Wash Racks

Process	Management Initiative / Good Idea
• Rags and Absorbents	Reuse Absorbent Material with Multiple Stage Storage Segregate Segregate Used Absorbents by Material Absorbed Use Lightweight Absorbents to Minimize Weight of Waste Purchase Pads Composed of Recycled Materials Use Laundering Program Launder and Reuse Coveralls Rather than Using Disposables Launder Rags In-House
• Spill Prevention	Use "Oil Caddies" or Drip Pans Reduce Intermediate Steps in Material Transfers
• General Facility Maintenance	Reuse or Recycle 55-Gallon Drums, Overpacks, Containers Install and Properly Maintain Oil/Water Separators Reuse/Compost Wood Pallets Minimize Water Usage with Recycling Floor Scrubber or Mop and Bucket Skim Oil from Wash Water with Preferential Absorbent Attach Catch Pans to Detroit Diesel Buses for Oil Drippage Replace Lifts Having USTs for Hydraulic Oil
• Fire Truck AFFF System Maintenance	Remove AFFF Before Bringing Into Shop Use Contaminated AFFF for Fire Department Exercises

AFFIRMATIVE PROCUREMENT / PRODUCT SUBSTITUTION

A section providing recommendations and information pertaining to Affirmative Procurement and Product Substitution is also included in the Transportation Model Shop Report. Product Substitution includes recommendations for the replacement of hazardous chemicals currently being used in vehicle maintenance processes with an environmentally friendly alternative. Attention has been given to replacements for Ozone Depleting Chemicals, EPA 17 Industrial Toxic Pollutants, and Toxic Release Inventory chemicals. Appendix A of the Transportation Model Shop Report presents a list of Product Substitution Data for easy identification of environmentally preferable products.

Affirmative Procurement is the selective acquisition of products containing recycled and reclaimed materials to replace products manufactured from raw materials in response to Executive Order 12783, "Federal Acquisition, Recycling and Waste Prevention". Purchasing reasonably priced items made from recycled materials reduces the demand for virgin feedstock, aids in slowing the filling of solid waste landfills, and reduces reliance on foreign raw materials, such as crude oil.

SUMMARY

The Transportation Model Shop report was created to reduce base efforts for identifying and implementing pollution prevention opportunities for vehicle maintenance processes. AFCEE recently contracted with Parsons ES to update the report to include technological advancements and more detailed descriptions. The Transportation Model Shop Report is a valuable tool for vehicle maintenance personnel and environmental managers for finding environmentally friendly and cost-effective alternatives.

Copies of the Transportation Model Shop report are available from the AFCEE Program Manager and PRO-ACT:

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